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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/802,048	03/08/2001	Chia-Lin Hsu	JC-6856-C	2769

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EXAMINER
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ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 08/14/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/802,048	Applicant(s) HSU ET AL.	
	Examiner Steven H. Rao	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 May 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17,21 and 22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-17,21 and 22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Applicants' amendment filed on May 22, 2002 has been entered on May 30, 2002. Therefore claims 1,3,5-13, 15-17 as amended by the amendment and claims 2,4 and 14 as originally filed and claims 21-22 presently newly added are currently pending in the application. Claims 18-20 have been cancelled.

Election/Restrictions

Applicant's election without traverse of claims 1-17 in Paper No. 4 is acknowledged.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-17 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas et al. (U.S. Patent No. 6,001, 730, herein after Farkas) previously applied and Penniman (U.S.. Patent No.5,373,229 herein after Penniman) newly applied.

With respect to claims 1 and 11, Farkas discloses substantially all the steps set forth in the claims as previously stated and incorporated herein by reference and for the following reasons.

Applicants' claim that Farkas fails to disclose/ suggest every claimed feature of the recited claims namely the second CMP process for removing the barrier layer of

Farkas is conducted with a slurry that contains silica abrasive and an ethylediamine additive. The ethylediamine additive in Farkas' slurry process is to provide a faster polish rate for the barrier layer 21 than dielectric layer 20 or the metal inter connect 22.

Farkas in the relevant part col. 7 lines 30-57 states :

> In FIG. 5, a second slurry 30 and a second polishing pad 32 are applied to the device 10. The second slurry is designed to remove the tantalum-based barrier layer selective to oxide and copper. The second CMP step of FIGS. 5–6 uses a slurry containing 1.0 wt % to 12.0 wt % of silica abrasive, 0.01 wt % to 2.0 wt % of an amine compound, with a remaining balance solvent (e.g., deionized water and/or an alcohol). Typically a slurry pH of 9.0 to 11.0 is preferred. Experimentation has shown that a preferred amine compound is an ethylendiamine additive. In one embodiment, a specific second CMP slurry, used in conjunction with a specific polishing pad (e.g., IC1400), was used wherein the slurry consisted of 7.5 wt % silica abrasive, 0.05 wt % ethylendiamine, and a remaining balance deionized water. In this process, the polish rate of TaSiN was roughly 550 angstroms/min, the polish rate of copper was roughly 330 angstroms/min, and the polish rate of silicon oxide was roughly 340 angstroms/min. Therefore, complete polishing of the copper interconnect and barrier can be accomplished in less than two minutes using the process taught herein.
>
> In another experiment, a Polytex "softer" polishing pad was used with a slurry comprising 1% ethylendiamine, Cabot Semisperse SCE abrasive, with a final pH of 10. for this experiment, a TaSiN polishing rate of roughly 470

Therefore it is not understood how applicants' conclude that the ethylendiamine additive's sole purpose is to provide a differential polish rate.

Secondly applicants' in one of their preferred embodiments describe their slurry as , " The slurries 110 and 112 , for example , can be a metal-polishing slurry that comprises water, abrasive particles, surfactant, buffer solution, and an anti-corrosive agent etc. ". Which is identical to Farkas' slurry , therefore what is true for applicants' slurry is also true for the reference Farkas and its slurry .

Farkas in col. 7 lines 9-29 describes a "oxide polish" and states :

> step of FIGS. 5–6. A subsequent oxide polish performed after FIG. 6 in addition to the copper/tantalum-based two-step polish illustrated in FIGS. 2–5 may be used. In order to perform the oxide polish (e.g., oxide touch-up), a third slurry and a third polishing pad are applied over the top of semiconductor structure after FIG. 6 in order to perform a third CMP operation. This oxide polish pad will preferably be the harder polish pad used to perform the first step of the second polish process or may be a similar, but different, polishing pad. The oxide slurry 30 is typically a silica abrasive which contains KOH and deionized water. This oxide slurry in conjunction with the harder polishing pad will enable effective removal of a thin top portion of layer 20 whereby the layer 20 is once again made co-planar with the top surface of the copper interconnect 28 if the polish of FIGS. 5–6 has not made the various layers 20–22 co-planar already.

Therefore for all the above reasons, Farkas contrary to Applicants' contention teaches second oxide slurry.

Further as will be seen from the discussion below, Farkas surely teaches or suggests adjusting the zeta potential of the metal surface during the removal of the barrier layer (added by the present amendment) to protect the integrity of the metal layer .

The phrase, " to protect the integrity of the metal layer " does not appear in the claims 1 and 11 and need not be given patentable weight. It is well settled that limitations form specification cannot be relied upon. In re Lundberg, 113 USPQ 530 (CCPA 1957).

With regard to Zeta potential a good starting point is the definition of zeta potential or Elektro- kinetic potential :

> Zeta potential is an electrokinetic property of particles suspended in an aqueous medium containing charged ionic species and is an expression of the charge developed on or adjacent to such particles. It has been recognised that the Zeta potential of fibrous particles in the feed stock or furnish, used in paper making, has a considerable influence upon the paper produced therefrom. Zeta potential cannot be measured directly; however, it can be calculated from measurements of a related parameter known as streaming potential.
>
> A general discussion of Zeta potential and its relevance to paper making is provided in "Electrokinetics in Paper Making—a position paper" by R. A. Stratton and J. W. Swanson in TAPPI, 64 No. 1, page 79–83 (1981). A survey of various methods of measuring Zeta potential, including those reliant upon measurements of streaming potential, is given in an article by H. J. Jacobasch et al. in Colloid and Polymer Science 263; 3–24 (1985).

(Penniman col. 1 lines 13-23).

Therefore Zeta potential is an elctrokinetic property of particles suspended in an aqueous medium containing charged ionic species and is an expression of the charge developed on or adjacent to such particles.

Farkas in col. 7 lines 57 to col. 8 lines 10 states :

> When using this two-step process taught herein, planarity was found to be within a deviation of roughly 200–1000 angstroms at a maximum. This is roughly a 1.5× to 4.0× improvement over all other known copper polishing techniques used on Cu/Ta-based dual inlaid stacks. In addition, sufficiently low copper removal rate (<500 angstroms/min for copper) was achieved in the second CMP step whereby CMP throughput was improved, reduced or eliminated pitting and corrosion of the copper material was shown whereby device performance and yield was improved,

> improved planarity of the copper layer was found over prior art techniques, improved electrical performance of integrated circuits was found, adequate selectivity of copper to oxide and copper to Ta-based barrier was found in the first CMP step, adequate selectivity of tantalum alloy to oxide and tantalum alloy to copper was found in the second CMP step, and improved removal of a tantalum-based barrier was achieved without adversely affecting the overall copper inlaid structure.

As shown above Farkas second CMP slurry is a deionized water based slurry containing containing charged ionic species (ehtyendiamine and other solids partially disassociated in water to form charged ionic species) . Further is known that charged ionic species (particles) in water have charges developed on or adjacent to such particles.

Therefore Farkas without specifically stating the words "zeta potential " clearly describes a method by which zeta potential is created.

Further the recited step of adjusting the zeta potential of the metal surface during the removal of the barrier layer is a functionally inherent step.

It is well settled law that, " it is elementary that the mere recitation of a newly discovered function or property, inherently possessed by things discovered function or property, inherently possessed by things in the prior art, does not cause a claim drawn to distinguish over the prior art. Additionally, where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown

to be in the prior art does not posses the characteristic relied on. In re Swinehart, 169 USPQ 226 (CCPA 1971).

It is also noted that Farkas describes the second CMP step or the oxide polish step as the barrier removal etch to etch layers 20-22 (including barrier layer 21) removal figs. 5 and 6).

Therefore all the limitations presently recited in claim1 is taught/suggested by Farkas.

Claims 2-10 and "12- 20" (sic. 12 –17) were alleged to be allowable because they depend upon allegedly allowable claims 1 and 11.

However, as shown above claims 1 and 11 are not allowable, therefore claims 2-10 and 12-17 are also not allowable.

With respect to claims 21 and 22, wherein the second slurry for removing the barrier layer comprises an oxidant, abrasive particles, surfactant, buffer solution and anti-corrosive. (Farkas col. 7 lines 10-55 and claims).

Response to Arguments

Applicant's arguments filed 5/30/02 have been fully considered but they are not persuasive. for reasons set out in detail above.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action.

Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. Rao whose telephone number is (703) 3065945. The examiner can normally be reached on 8.00 to 5.00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703)3062794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 7463926 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 3067722.

SHR
8/08/02

Olik Chaudhuri
Supervisory Patent Examiner
Technology Center 2800